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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/005,803	12/05/2001	Hsin-Ching Shih	TS01-663	9432
28112 7590 11/19/2003 GEORGE O. SAILE & ASSOCIATES 28 DAVIS AVENUE POUGHKEEPSIE, NY 12603			EXAMINER CHEN, KIN CHAN	
			ART UNIT 1765	PAPER NUMBER

DATE MAILED: 11/19/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/005,803

Applicant(s)

SHIH ET AL.

Examiner

Kin-Chan Chen

Art Unit

1765

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 03 October 2003.
- 2a) ☒ This action is FINAL. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-7,9 and 11-16 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-7,9 and 11-16 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. §§ 119 and 120

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.
- 13) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application) since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.
a) ☐ The translation of the foreign language provisional application has been received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121 since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ 6) ☐ Other: _____

DETAILED ACTION

Specification

1. The abstract of the disclosure is objected to because the amended disclosure does not set forth a method for the removal of solvents from exposed surfaces. Correction is required. See MPEP § 608.01(b).

Claim Rejections - 35 USC § 112

2. Claims 1-7, 9, and 11-16 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

The **amended specification** does not set forth a method of **applying solvents** for the removal of polymer. Furthermore, in the reply (October 3, 2003) to the office action, applicant states (pages 17, 18, and 24) that the solvent has negative impact on contact resistance, high cost, difficult to apply, and eliminate the using of a solvent to remove polymer. As such, it is unclear to one skilled in the art that how the solvents being applied in the claimed invention to remove the polymer.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. Claims 1-5, 12-14, and 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over admitted prior art in view of Catabay et al. (US 6,503,840; hereinafter "Catabay").

The admitted prior art is relied on only to show the conventional dual damascene process comprising: providing a substrate with at least one point of electrical contact comprising copper; depositing an etch stop layer over the substrate; depositing at least one layer of dielectric over the surface of the etch stop layer; creating at least one opening through at least one layer of dielectric provided over the surface of the etch stop layer, at least one opening having sidewalls and a bottom surface; removing the etch stop layer from the bottom surface of the at least one opening (specification, pages 2-4).

Unlike the claimed invention, admitted prior art does not teach that after at least one opening is created, applying the first plasma treatment to the exposed surfaces, applying a DI water rinse, applying a second plasma treatment to the exposed surfaces.

In a method of forming damascene structure, Catabay teaches the etching residues are accumulated over exposed surfaces (so-called accumulation of polymers

over exposed surfaces in the instant claims). Catabay teaches that after at least one opening is created, applying the first plasma treatment (such as oxygen) to the exposed surfaces, applying a commercially available solvent for rinsing, applying a second plasma treatment (such as hydrogen) to the exposed surfaces (col. 6, lines 30 to col. 7, lines 30) in order to have a reduced number of unfilled or unsatisfactorily filled openings. Hence, it would have been obvious to one with ordinary skill in the art to use the said process steps of Catabay in the conventional dual damascene process (admitted prior art) in order to have a reduced number of unfilled or unsatisfactorily filled openings. Catabay is not particular about the commercially available solvent, hence, it would have been obvious to one with ordinary skill in the art to use DI water because it is one of the most popular commercially available solvent for rinsing.

As to dependent claim 5, Catabay teaches using plasma treatment of oxygen to passivate the low-k dielectric. Dependent claim 5 differs from Catabay by specifying removing polymer residues (e.g., sidewalls of the openings). However, the same material (oxygen plasma) is used with the same process steps, it appears that the method of the combined prior art would inherently contain the same properties and functions as claimed (e.g., removing polymer residues).

A newly discovered property (function) does not necessarily mean the product is unobvious, since this property (function) may be inherent in the prior art. *In re Best* 195 USPQ 430 (CCPA 1977); *In re Swinehart* 169 USPQ 226 (CCPA 1971). However where functional language is used in a process, the burden shifts to applicant to establish that the reference does not inherently function in the manner required by the claims. *Ex parte Bylund* 217 USPQ 492 (PO BdPatApp 1981); *In re Hallman* 210 USPQ 609 (CCPA 1981). *In re Fitzgerald et al.* 205 USPQ 594.

As to dependent claims 2-4, 12 and 13, because the same plasma are used for cleaning the residues in the openings, it appears that the method of Catabay would inherently contain the same properties and functions as claimed (such as providing chemically interaction that enabling the removal of the residues; byproducts of the first plasma treatment being water soluble; not causing damage).

A newly discovered property (function) does not necessarily mean the product is unobvious, since this property (function) may be inherent in the prior art. *In re Best* 195 USPQ 430 (CCPA 1977); *In re Swinehart* 169 USPQ 226 (CCPA 1971).

5. Claims 6,7,9, 11 and 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over admitted prior art and Catabay as applied to claims 1-5, 11-14, and 16 above, and further in view of Zhao et al (US 6,204,192; hereinafter "Zhao").

The discussion of modified admitted prior art and Catabay from above is repeated here.

Unlike the claimed invention, the combined prior art of admitted prior art and Catabay dose not teach using the nitrogen with oxygen (claims 6 and 7), in the method of removing etch residues and cleaning the exposed surface of openings, Zhao (col. 8, lines 30-39) teaches that a plasma of nitrogen, oxygen, or a combination of nitrogen and oxygen may be used. Hence, It would have been obvious to one skilled in the art to use nitrogen (claim 9) or the combination of nitrogen and oxygen (claims 6 and 7), rather than oxygen in Catabay's process because Zhao **teaches the equivalence between using these plasma** in the process that are similar to those as taught by Catabay. The substitution of one for the other would have been expected to provide the expected result. As to dependent claim 11, Zhao teaches low-k dielectric (abstract, Figures).

As to dependent claim 15, Zhao (col. 8, lines 40-48) teaches that hydrogen plasma may be used for removing etch residues and cleaning the exposed surface of openings. Nitrogen gas may also be used to facilitate ignition of the plasma (col. 5, lines 30-32). Hence, it would have been obvious to one with ordinary skill in the art to modify Catabay's process by using hydrogen and nitrogen as taught by Zhao so as to facilitate ignition of the plasma.

The above-cited claims differ from the prior art by specifying well-known features (such as using argon carrier gas and plasma reactors in claims 6, 7, 9, and 15) to the art of semiconductor device fabrication and using various processing parameters (such as claims 6, 7, 9, and 15). However, process parameters are commonly determined by routine experiment. The process of conducting routine optimizations so as to produce an expected result is obvious to one of ordinary skill in the art. Hence, A person having ordinary skill in the art would have found it obvious to modify the combined prior art by performing routine experiments by using different processing parameters to obtain optimal result and adding any of same well-known features to same in order to provide their art recognized advantages and produce an expected result. It is noted that applicant did not traverse the aforementioned conventionality (e.g., well-known features, obviousness), which have been stated in the office action in June 10, 2003, MPEP 2144.03.

Changes in compositions, temperature, concentrations, or other process conditions of a process do not impart patentability unless the recited ranges are critical (i.e., they produce a new and unexpected result that differs in kind and not merely in

degree from the result of the prior art). *In re Woodruff*, 16USPQ2d 1934,1936 (Fed. Cir.1990); *In re Hoeschele*, 406 F.2d 1403, 160 USPQ 809; *In re Boesch*, 617 F.2d 272, 205 USPQ 215 (CCPA 1980).

Response to Arguments

6. Applicant's arguments filed October 3, 2003 have been fully considered but they are not persuasive.

Applicant has argued that Catabay does not teach removing the etch stop layer from the bottom surface of the at least one opening. It is not persuasive. As has been stated in the office action, the conventional dual damascene process comprising removing the etch stop layer from the bottom surface of the at least one opening, and admitted prior art is relied on to show these conventional features. Therefore, the **combined** prior art teach said features.

One cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. *In re Merk &Co., Inc.*, 800F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986).

Applicant has argued that Catabay teaches using oxygen plasma to passivate the low-k dielectric rather than cleaning the polymer residues in the openings. In response, as stated in the office action, the same material (oxygen plasma) is used with the same process steps, it appears that the method of the combined prior art would

inherently contain the same properties and functions as claimed (e.g., removing polymer residues). See the case law cited in the office action.

In response to applicant's argument that the references fail to show certain features of applicant's invention, it is noted that the features upon which applicant relies (i.e., page 26, polymers potentially mixed with copper oxidation; the removal of solvents from semiconductor surfaces) are not recited in the rejected claim(s). Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993).

Applicant has argued that the properties and functions in dependent claims 2-4 are not taught in the prior art. As has been stated in the office action, because the same plasma are used for cleaning the residues in the openings, it appears that the method of Catabay would inherently contain the same properties and functions as claimed (such as providing chemically interaction that enabling the removal of the residues; byproducts of the first plasma treatment being water soluble; not causing damage). See the case law cited in the office action.

Applicant has argued that Zhao does not provide the three steps that are provided by the claimed invention. As has been stated above, the **combined** prior art teach said features. One cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. In *re Merk & Co., Inc.*, 800F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986).

Applicant has argued that Catabay does not provide a second plasma treatment interrupted by a DIW rinse. As has been stated in the office action, Catabay teaches that after at least one opening is created, applying the first plasma treatment (such as oxygen) to the exposed surfaces, applying a commercially available solvent for rinsing, applying a second plasma treatment (such as hydrogen) to the exposed surfaces in order to have a reduced number of unfilled or unsatisfactorily filled openings. Hence, it would have been obvious to one with ordinary skill in the art to use the said process steps of Catabay in the conventional dual damascene process in order to have a reduced number of unfilled or unsatisfactorily filled openings. Catabay is not particular about the commercially available solvent, hence, it would have been obvious to one with ordinary skill in the art to use DI water because it is one of the most popular commercially available solvent for rinsing. Applicant has not commented on or acknowledge same.

Conclusion

7. THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the

shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kin-Chan Chen whose telephone number is (703) 305-0222. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on (703) 305-2667. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306. Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-2934.

November 14, 2003


KIN-CHAN CHEN
PRIMARY EXAMINER